A GIS–Based Interactive Database System for Planning Purposes

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INTRODUCTION

Decision making in planning should consider state-of-the-art techniques in order to minimize the risk and time involved. Proper planning in developing countries is crucial for their economical recovery and prosperity. Proper database systems, such as the ones based on GIS, are a must for developing countries so that they can catch up and build effective and interactive systems in order to modernize their infrastructures and to help improve the standard of living of their citizens. The huge and fast advancement in computing and information technology make it easy for the developing countries to build their database infrastructures. GIS-technology is one of the best and fastest tools to build such systems, manage resources, encourage businesses, and help to make efficient and cost-effective decisions.

For the purpose of a better informed decision making in planning the improvement of the Bank of Jordan in the city of Amman, Jordan, we had to build a database system and a digital map for the city of Amman, the Bank of Jordan, its branches in Amman, and all other banks and their branches in Amman. We used the popular Geomedia software to allow an interactive time-saving data management; to offer the ability to perform different analysis, including statistical ones; and to provide graphical geospatial results on maps. By using Geomedia software, we built many layers needed for the planning processes and mainly for the region of Amman due to the lack of available digital data in the area. Some layers concern the project and relate to the bank, such as the geographic distribution of the Bank of Jordan branches and its ATMs; and others for the comparison, such as the geographic distribution of all other banks, their branches, and ATMs in Amman. This is to allow the decision makers to compare with all competitive banks in Amman. Besides the geographic location of all existing banks, important attribute data are provided for the Bank of Jordan in specific and all the other banks in general (Batty et al., 1994a, 1994b; Burrough et al., 1980; Doucette et al., 2000; Elmasri & Navathe, 2004; Goodchild, 2003; Longley et al., 1999a, 1999b).

BACKGROUND

The Bank of Jordan started planning for new ATM sites in Amman using the traditional method and, at the same time, the GIS pilot project to support building a quick goespatial information infrastructure that can assess in the decision-making process according to provided criteria, which can be integrated into the GIS analysis process. The real challenge here is to build a digital database to introduce a complete digital map for Amman to help in the analysis process.

Many layers for different purposes are created, including the country boundaries, governorates boundaries, city districts and subdistricts, main and submain streets, blocks and city blocks, government organizations, commercial areas and trading centers with cinemas and theaters, commercial companies, insurance companies, restaurants, hotels, hospitals, gas stations, Jordan Bank branches layer, and the branches of all other banks with their ATMs in the city of Amman.

The design of these layers is based on a specific GIS data model suited for this application. It is based on integrating SPOT image of Amman with many scanned paper maps that provide the needed infor-

mation. Moreover, integration of Geographical Positioning System (GPS) data into our GIS system is implemented to create many layers required for the analysis.

Once the geospatial database for the city and the banks is ready, the rest of the work is easy and flexible, and the planners can integrate their functions and conditions in no time and will be able to provide better decision making. Moreover, part of the data could be made public and accessible through the Web to help not only in locating the sites of ATMs but also in doing the banking interactions, which is a sort of human computer interaction mechanism as it is done in the developed countries (Batty et al., 1994a; Burrough et al., 1980; Goodchild, 2003; Longley et al., 1999a, 1999b).

METHODOLOGY AND MODELING

Using scanning, digitizing, and registration techniques as well as collected and available attributes of data, many layers were created for the database. Figure 1 illustrates the general procedure for creating the needed layers.

Many basic geospatial data layers were built (by feature) for the project, as follows:

1. Line features such as (street layers) highways, subways, roadways, and railways.
2. Polygon features such as urban, circles, farms, gardens, Jordan Governorates, Amman districts, Amman subdistricts, and so forth.
3. Point features such as banks and/or ATMs, restaurants, hotels, large stores, hospitals, sport clubs, cinemas (movie theaters), cultural and social centers, gas stations, and police stations.

Figure 2 illustrates a descriptive diagram of the GIS data model creation, measuring, development, and implementation stages.

IMPLEMENTATION

SPOT image is used as the registration reference frame for all scanned hardcopy maps, as indicated in the schematic GIS data model in Figure 2. The reference system is the Jordanian Transverse Mercator (JTM). Figure 3 illustrates the reference points in the registration process using the Geomedia software.

Digitization is followed to create the polygon and line layers. Figure 4 shows a digital scanned map image while digitizing, and the drawn redline is the digitized line on the map.

Figure 5 (parts a, b, and c) shows examples of the resulting layers (maps) using line features such as highways, subways, and roads digitized layers, respectively.

Figure 6 (parts a, b, c, and d) shows examples of the resulting layers (maps) using polygon features such as district, subdistrict, urban, and governorate layers, consecutively.

Figure 7 shows some of the created layers for banks, ATMs, hospitals, and gas station locations. Finally, imposing all of the previous layers, a final resulting map was made available to help in the decision-making process. Any kind of information could be provided from any layer to help in the planning, improvement, or finding of the location of an ATM, a new bank branch, and so forth.

Figure 1. Overview of the GIS project procedure
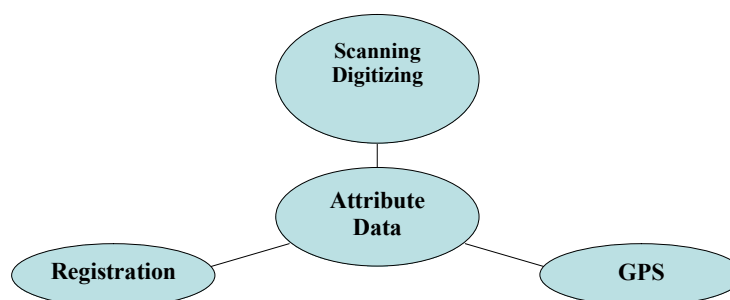
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